

Executive Function

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Purpose of Session on Executive Function

The following information describes the brain-controlled function that is known as ***executive function***, which guides various functions of the body through planning, organizing and actually directing the body to carry out the activities of our lives. ***Executive function*** involves developing initiatives, making appropriate decisions, shifting to the next steps that are needed, and stopping a finished action or task.

Executive Function (of the Frontal Lobes of the Brain)

Managing our lives includes planning and carrying out many activities, such as getting ready for a meeting or appointment, making sure there are supplies and time scheduled for meals or for gardening, short-term plans such as putting together the day's outfit, and long-term goals such as every week adding to a savings account for college expenses, a new car, or a summer trip. Such planning and carrying out of activities depends greatly on the *executive function* of the frontal lobes of the brain.

The frontal lobes are located in the top front part of the brain, right behind the forehead. This part of the brain has controls over many body functions. It continues to develop through adolescence and into adult life. Some of its functions include managing body movement (motor function), emotions, attention, motivation, and other thinking functions such as decision-making, judgment, abstract reasoning, planning and completing tasks, working memory, and meeting goals.¹⁻⁵ Examples of some of the thinking functions include:

1. **Judgment:** using past experiences, considering values, and applying appropriate limits on behavior, for example considering appropriate timing and space limits and inhibiting behaviors that would ruin relationships or land us in jail. Another example is not to buy that great offer from the unknown salesperson at your front door because you do not know that person and it may be a scam.

2. **Decision-making:** considering choices and selecting a preference (likes and dislikes) to make a decision, for example, choosing a warm outfit from the closet during cool weather or a heart-healthy meal from the **restaurant** menu.
3. **Planning and doing all the activities** of an event: organizing a celebration for a future time, for example, planning an open-house for a large number of relatives and friends to celebrate the birthday or other milestone of a family member.

Executive Function: the Term

Executive function is a term used to describe the management of these activities. The term “executive function” comes from the business world where the top executive organizes, decides, adjusts, and supervises the activities of the business. Essentially, the executive function of the frontal lobes is to be “in charge of” the body. A way to think of *executive function* is to think of the idea and duties of a boss, manager, or business owner who is in charge of a store or project, more specifically, in charge of the ideas, plans, budget and goals, the deadlines for all the work details, the products sold, and all the people in the organization.^{6,7}

The *executive function* of the frontal lobes has the responsibility for planning and paying attention to important needs and actions of the body. Executive function includes: controlling, starting, stopping, regulating, adjusting to change, planning when faced with new settings or situations, forming ideas, controlling emotions, and thinking abstractly. In other words, executive function includes choosing: what to do, how long to do a current action, when to shift to the next step, and when to stop. Feedback about the quality of the action leads to corrections or going on to the next step to the point of completion. For example, information from the body such as signals about feeling hungry or tired lead to thoughts and plans to ignore, delay, or act immediately on those signals.^{5,8,9}

Executive Function: Main Duties
1. Start
2. Maintain
3. Switch
4. Stop

A look at the multiple steps of planning will provide an example of the high level of brain work in executive function.⁵

Step 1: Think about the problem and what needs to be done.

Step 2: Create a way to solve the problem. Think about resources, past experience, values, etc.

Step 3: Do the steps to solve the problem.

Step 4: Evaluate the outcome, is it good, is it adequate, is it finished, or is more needed?

Executive Function: Subtle Activities to Handle Main Duties

1. Forming ideas to do an action.
2. Starting an action.
3. Maintaining an action until the step is finished (knowing when a step is finished).
4. Switching behaviors to do the next step needed.
5. Regulating, controlling, and adjusting body actions to deal with changes and new information along the way.
6. Planning a tactic down the road to deal with a new issue or new direction.
7. Holding details in the working memory.
8. Controlling emotions.
9. Thinking abstractly.
10. Knowing when the whole task is finished and stopping the series of actions.

Decline in Executive Function

Damage to the frontal lobes or the cells that send information to the frontal lobes may result in declining function. Research has shown some decrease in executive function as people age.¹⁰⁻¹³ In the case of sudden injury to the frontal lobes such as in a stroke or a head injury, there may be sudden lost function(s) from this area of the brain.

When there is slow progressive decline such as with Alzheimer's disease, a frontal dementia, or a related progressive memory disorder, there may be wavering abilities; some days the executive function may be better and some days it may be worse. Or, slowly over time there is progressive decline in

different executive functions and a caregiver has to take over some part of or all of the executive functions.

Brain cell changes that result in decline in executive function could interfere with memory, applying good judgment to choices, and paying attention long enough to a conversation to be able to respond appropriately. Examples of difficulties include:

1. Difficulty of the body to do the correct order of steps to perform an action, such as walking, speaking, lifting up an object and putting it down, or operating a telephone.
2. Difficulty starting, continuing, shifting, or stopping an action such as all the steps needed to eat a meal until one is full. The person may need reminding "to take another bite", have a spoonful of yogurt, etc. during the meal by someone else.
3. Difficulty holding pieces of information in the working memory system to guide choices, forgetting key pieces of information and thus, making wrong choices, for example, forgetting an announcement about a friend not coming to an event and then a few minutes later asking people why that person is so late in coming. Or, not being able to remember the costs of the items just selected and struggling to count out the right amount of money (of course, most people rely on credit cards to handle purchases these days).
4. Difficulty being appropriate and honoring limits, for example knowing when to add comments to a discussion, not touching or speaking to strangers, or not handling an art object (next to a "Do Not Touch" sign) at a store or museum.
5. Difficulty holding back spontaneous actions or comments though they may be rude, hurtful, untimely, or against the rules or the law. May be surprised when spontaneous behavior causes trouble such as racing a car through a stop sign or an intersection where the traffic light just turned red.
6. Difficulty keeping emotions stable, in other words having sudden outbursts of anger, acting irritated or rude, or laughing when others are serious or grieving the loss of a loved one. The emotions may appear disconnected from genuine concern (in other words the person may appear indifferent to the emotion expressed). The emotion may be extreme or not fit the situation or the interactions of others.
7. Difficulty keeping up with the pace of activity or conversation. Acting very slow in thinking, body movements, and talk as if suffering from "jet lag" or moving the same way as actors in a slow motion movie.
8. Difficulty thinking about consequences before acting though still highly intelligent. Unable to apply past consequences to current choices or actions.

9. Difficulty shifting from one set of ideas, a phrase, or actions to the next step or to a different idea or activity. Acting as if stuck in a rut for a period of time.
10. Difficulty planning new actions when there is an unexpected change, for example seeing that a street and sidewalk are closed for repair and walking there anyway.
11. Difficulty monitoring oneself to realize a mistake and apologize or to do a different more appropriate behavior.¹⁴

Dementia

“Dementia” is a general term that refers to decline in thinking and/or memory function while an individual is awake and alert. The decline is enough to interfere with normal daily functioning, on the job, at home, or in relationships.

“Progressive” dementia progresses, in other words, it becomes worse over time.

When brain cells change and there is decline in executive function, family members may start noticing mild problems in finishing tasks, a lack of interest in visiting friends or family, or behavior, such as getting too close to talk to someone, that makes other people uncomfortable. The new behaviors may be very different from the previous style of behavior for that person. Or, the behaviors may be more intense or an exaggeration of what used to be typical for that person, for example, in a group, talking too loud, speaking too long, always interrupting others, and answering questions that are addressed to others. It is important for the person who is undergoing these changes to have a full medical evaluation.

Medical Evaluation

The medical evaluation should be thorough. The evaluation should include a physical exam, a neurological exam, a neuropsychological exam with tests of frontal lobe function¹⁵⁻¹⁸, information about the person’s medical and surgical history, the family medical history, a social history (information about education completed, jobs, skills, relationships, hobbies, interests, etc.), a list of prescribed and over-the-counter medicines as well as vitamins, minerals, herbs, etc. Blood tests should evaluate electrolytes, sedimentation rates, cholesterol, triglycerides, urea, liver functions, vitamins such as folate and B12, body hormones such as a thyroid screen, and infections. Tests of urine are also important. If there is a suspicion of seizures, an EEG (electro-encephalogram) is appropriate. When the person reports that symptoms appear over a short period of time such as a few days or weeks, a spinal tap may be important to rule out infection as the cause of the changes.¹⁹

The medical evaluation should include an MRI (magnetic resonance imaging) or CT (computed tomography).¹⁹ MRI or CT films of the brain tissue that show a loss of brain cells, called atrophy, in the frontal lobes (front top part of the brain) may be the additional factor in addition to all the other tests that points to a frontal type of dementia. The frontal lobe dementia may be of several different types such as a general frontal dementia, a frontotemporal lobar degeneration, a frontal subcortical dementia, or a small, more focused frontal lobe dementia resulting from a stroke.¹⁹⁻²³

NOTE: More information about frontotemporal lobar degeneration is available at www.AlzOnline.net with the link to *Frontotemporal Lobar Degeneration (FTLD)*, which consists of three sections.

An MRI or CT that shows a larger area of the atrophy may indicate the involvement of many brain systems such as in a possible Alzheimer's disease. Alzheimer's disease shows a more general atrophy all over the "cap of the brain" (the cortex or top area of the brain) on MRI (or CT).^{18, 23}

Care Management

Living a healthy lifestyle such as including regular meaningful tasks that contribute to the family in some way, daily physical exercise, social activities, leisure activities, and brain exercise, is important. Good nutrition includes fresh fruits and vegetables in the daily meals and drinking lots of water (8 to 10 glasses or more a day unless a physician limits fluids).

Treatment with Medicine

The physician will recommend that the person with the diagnosis switch or stop all medicines, such as antihistamines (many anti-allergy medicines, anti-spasm medicines, sleeping pills, and cough medicines), that interfere with memory, communication, and other cognitive (thinking) functions. Other medicines that do not interfere with thinking functions may be prescribed for the existing health conditions such as high blood pressure or arthritis.

Research suggests that serotonin, a chemical that the body makes, is important to the function of the frontal lobes. Serotonin in the brain helps carry information from one neuron to the next. Low levels of serotonin increase with SSRIs (selective serotonergic reuptake inhibitor medicines). SSRIs have helped some patients with behavioral difficulties^{24,25}, not only depression, but also have helped with impulse control.^{25,26}

Whenever there is a question about prescribed medicines or over-the-counter medicines, herbs, vitamins, etc. people should check with experts regarding the impact on health. Good sources to check regarding any therapeutic or, the opposite, negative effects of medicines, vitamins, herbs, etc. are a physician **and** a pharmacist (**ask both people!**).

Driving

With decline in executive function, driving may become unsafe. A medical evaluation may result in the physician recommending limits on driving, a comprehensive driver evaluation, or stopping any driving. Changes in judgment, decision-making, predicting consequences, and handling multiple pieces of information coming into the brain, impair driver skills.

The following signs indicate clearly that a comprehensive driver test is needed or that the person should stop driving altogether:

- Any confusion about operating the vehicle such as how to start, shift, park or stop the vehicle.
- Any trouble noticing cars or pedestrians on either side of the road and the passenger suddenly shouts to the driver, "Watch out!"
- Any near misses such as almost hitting another car when changing lanes.
- Any side swipes even side swiping bushes on the driveway.
- Any accidents including a small fender-bender.

NOTE: A comprehensive driver evaluation test may take three to four hours and usually involves tests of the: memory, cognition (thinking functions), vision, and other tests in addition to the on-the-road test.^{19,27}

Not driving means not driving any type of motor vehicles such as cars, trucks, vans, all terrain vehicles, snowmobiles, motorbikes, golf carts, rider lawn mowers, motor boats, etc. Planning ahead for alternative transportation should occur long before it is clear (because of an accident or near miss) that the family unit no longer has a safe or available driver.²⁷⁻³¹ [More information about driving issues is available at www.AlzOnline.net at the link to the *Series: Driving and Progressive Dementias*.]

After the Diagnosis: Planning Ahead for Care

After the medical evaluation and the diagnosis, education about the condition and planning ahead are essential for long-term care management³². A decline in executive function may disrupt family life when it affects a person in their 40s or 50s because of their multiple active responsibilities. That person may be supporting a family, may be a full-time homemaker caring for children or grandchildren, may be serving as a community leader, and may be essential to the healthful daily function of so many other people and organizations.

Planning Ahead

As soon as possible the family should plan ahead; family matters, such as financial, legal, and health planning, should be discussed and organized^{19,32}. A ***Checklist on Family Matters*** is available to guide planning ahead which includes planning about money and legal matters, health preferences, organizing bill payments, and keeping forms up to date (see www.AlzOnline.net and link to *A Checklist on Family Matters* to download a copy).

These plans should be discussed with at least one trustworthy person who does not live under the same roof as the person with the disease. The back-up plans should consider resource people, such as family or neighbors, and resource programs and services such as local support groups and chapters of the national Alzheimer's Association, and Alzheimer Resource Centers.

People with a decline in executive function may be vulnerable to scams, spending large amounts of money on worthless products such as cures for aging or unnecessary home repairs. Family caregivers need to plan ahead to secure finances (bank accounts, credit cards, investments, etc.). A family attorney and accountant can help set up appropriate legal and financial matters so that the family resources are managed appropriately and have adequate checks-and-balances, especially in the event of any emergency.

A storm or other disaster that creates electrical shortages or destroys the home may lead the person with the diagnosis and the family caregiver(s) to a temporary move in another setting. If the people at this temporary setting have information about the health situation and daily care needs, it should ease the transition and the adjustment to the temporary setting.¹⁹ Some community programs register people ahead of time for local shelters that will provide a temporary place for people with special needs in the event of evacuations due to fires, bad weather or other emergencies.

It may help to set up ahead of time a "crisis carton". The crisis carton should be a large plastic (waterproof) container with a tight-fitting cover. Items to pack include copies of important health information, contact names and phone numbers, simple clothing for a few days, undergarments (disposable underwear for incontinence), family photos, paper and pens, a battery operated radio and flashlight, fresh batteries, a cell phone charger, a first aid kit, blankets, and snacks (canned liquids and dry food).

Simplifying Duties at Home

Family and paid caregivers should try to keep the schedule at home as routine, simple, safe, and pleasant as possible. Since a decline in executive function affects judgment, limits thinking about consequences when making choices, and decreases sensitivity about appropriate timing and limits, it is important to partner with or restrict some of the activities the person normally handled. The caregiver should gradually decrease responsibilities that involve that person paying the bills, handling all the mail, using machinery with many attachments or controls, caring for others especially children, or doing complicated or multi-step tasks alone.^{19,32}

Caregiver Tips

Caregivers of someone with progressive decline in executive functions should gradually take on more household and personal care responsibilities over time. It is important for caregivers to learn how to conserve their energy by prioritizing tasks; they should consider limiting less enjoyable tasks, or unpleasant social events, or other stressful commitments. Doing what is most important and omitting unimportant chores help to conserve energy. Some fussy details in housekeeping and some burdensome friends are worth ignoring.

A sense of humor can reduce stress, refocus the attention, and keep the setting positive. It is important to observe unpleasant or stressful behaviors early and try to avoid any problems before they start. Sometimes it helps to shift attention quickly with a change of subject, a change of pace, a louder voice or a softer voice, slower speech (repeating simple phrases), or a change of activity such as getting a snack. Sometimes the caregiver just needs to leave the room or go outdoors for a few minutes to clear her or his head. It may be better to start another, easier task and leave the problem task for a later time. Sometimes it helps to quiet the setting, such as closing the windows, unplugging the telephone or T.V. or ushering visitors to another room, outdoors, or (their) home.

A clever way to think about providing care is to remember the word "**KISSSSS**". In other words, **Keep** it **Sweet** (positive), the **Same** (routine), **Simple** (priorities only, doing only what is important and preferred), **Short** (brief: activities, explanations and conversations), and **Safe** (safe: activities, setting, behaviors for everyone especially the caregiver).

A family or paid caregiver **must have respite**, a regular timeout for "down time", rest and relaxation. **Regular respite is critical!**³²

In addition to receiving medical advice regarding recommendations for health care and available treatments to improve function, the family should educate themselves about the medical diagnosis in anticipation of future changes in abilities. The type and rate of changes and the decline in ability differ from person to person. Family members need to realize that everyone changes differently depending on which cells in the brain are getting weak or not functioning. There may be "good days" and then "not-so-good-days". Later, there may be brief "good moments" and then longer "not-so-good-moments".

Resources

Many resources are available to help caregivers and care receivers with education, support groups or other services whenever appropriate. A younger person who is employed and needs to file for disability benefits because of the executive function problems resulting in a diagnosis of a progressive dementia should contact the local social security office to begin the application process (the national information number provides local contact phone numbers: Social Security 1-800-772-1213 or www.ssa.gov).

Other important resources include local chapters of the Alzheimer's Association, different groups who deal with progressive dementia such as the Alzheimer Resource Centers, the Association for Frontotemporal Dementias, adult day (health) care programs, senior centers, meal sites, religious organizations with programs or special services, assisted living facilities, nursing homes, volunteer groups and neighbors.²⁸

Because information on the (computer) internet is available 24 hours a day, the internet provides readily available (usually free) help. Entering in a name of a diagnosis or a medicine or a challenging behavior will result in a wealth of explanations and suggestions. Some excellent internet web sites and toll free phone numbers are listed in the following table.

Internet sites and Toll Free Phone Numbers
→ Association for Frontotemporal Dementias: www.ftd-picks.org
→ Alzheimer's Association (USA): www.alz.org or www.alzheimers.com ; (800)272-3900
→ Alzheimer Society of Canada: www.alzheimer.ca
→ AlzOnline (at University of Florida): www.AlzOnline.net
→ National Academy of ElderLaw Attorneys: www.naela.org or (520)881-4005
→ Social Security (800)772-1213 or www.ssa.gov

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